

REMARKS

CLAIM 1 AND ITS DEPENDENT CLAIMS

The Examiner rejected Claim 1 under 35 U.S.C. 103(a) as obvious over Fermann et al (5,627,848) in view of Wyatt et al (5,422,897). The Examiner stated that all of the elements of Claim 1 were disclosed in Fermann et al, except for the use of multi-mode fiber. Further, the Examiner argued that Wyatt et al teaches the use of Multi-Mode fiber in a laser, and that it would be obvious to combine these references to produce the claimed combination. Specifically, the Examiner directed attention to the following sections of Wyatt et al: Column 1, lines 67-68; Column 2, lines 1-2; and Column 6, lines 62-64. Applicant acknowledges that Wyatt et al discloses a laser having both single mode fiber and Multi-mode fiber situated along the cavity axis. However, Applicant believes that the fundamental focus of Wyatt was to solve the difficulty of end-pumping a single mode fiber with a laser diode array. This is clear from the background section of Wyatt. In order to inject the pump light from a laser diode array into the end of the fiber (Wyatt Figs. 1 through 3 at g1), Wyatt states that the numerical aperture of the fiber must be increased beyond single mode (See Col. 1, lines 55-62), and thus he introduces the concept of a doped multi-mode fiber in the cavity.

The present application, on the other hand, utilizes cladding-pumped fiber (a concept which Wyatt states is too complex and prone to launch-condition difficulties: See Col. 2, lines 3-10). With cladding-pumped fiber, the numerical aperture no longer needs to be modified to accommodate high pump power. The present application is the first to recognize that the use of doped multi-mode fiber along the laser axis permits the concentration of more stored energy in the fiber core for absorption by the signal light, regardless of whether the laser is end-pumped or cladding-pumped.

Simply stated, Wyatt does not suggest using doped multi-mode fiber with a cladding-pumped laser, and in fact teaches away from this approach at Col. 2, lines 3-10.

Claim 1 has been amended to define, in part:

“ a length of multi-mode optical fiber having a cladding and doped with a gain medium and positioned along said cavity axis;

a pump coupled to said cladding for exciting said gain medium;”

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In view of the fact that Fermann et al does not teach the use of multi-mode fiber in his pulse laser, and that Wyatt teaches against the use of cladding pumping, Claim 1 should be allowed as amended.

While Applicant believes that the claims which depend from Claim 1, namely Claims 2-50, should be allowed in view of their dependence on Claim 1, certain rejections made by the Examiner warrant special note.

With regard to Claims 7 and 8, at page 4 of the Office Action, the Examiner suggested that Fermann discloses a tapered fusion splice at Col. 7, lines 28 to 43 and Column 8, lines 11-22. Applicant finds no suggestion of tapering the splice at those locations in the Fermann et al specification.

With regard to Claims 13 and 14 at page 4 of the Office Action, the Examiner suggests that Fermann discloses a pump coupled to the side of a multi-mode fiber. In fact, Fermann et al does not suggest a multi-mode fiber, and does not suggest cladding pumping.

At page 7 of the Office Action, in reference to Claim 30, the Examiner states that Fermann discloses ultra-short optical pulses preferentially in the fundamental mode of a multi-mode fiber. In fact, Fermann does not disclose the use of multi-mode fiber for such pulses.

With regard to Claim 46, at page 9 of the Office Action, the Examiner states that Fermann discloses a laser using a multi-mode core with gain medium concentrated centrally within the multi-mode core. No such disclosure is found in Fermann.

With regard to Claim 47, at page 9 of the Office Action, the Examiner states that Fermann discloses multi-mode fiber which is polarization-maintaining. Again, Fermann does not disclose multi-mode fiber.

Also at page 9 of the Office Action, the Examiner states with regard to Claims 48 and 49 that Fermann discloses polarization maintaining multi-mode fiber having an elliptical core. And multi-mode fiber having stress-producing regions. Fermann does not disclose multi-mode fiber.

Applicant urges the allowance of Claims 1-50.

CLAIM 55 AND ITS DEPENDENT CLAIMS

The Examiner rejected Claims 55-57 on the same combination of Fermann et al and Wyatt et al as was used in the rejection of Claims 1-50. Applicant has amended Claim 55 to define:

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“ amplifying said light energy within said laser cavity in a bent multi-mode fiber; and”

Clearly, the multi-mode fiber of Wyatt is straight. See Wyatt figs. 1, 2 and 3. In fact, Wyatt teaches that, in order for the fundamental mode of a multi-mode fiber to propagate down a multi-mode fiber, even for distances up to one meter, the fiber should be straight, to avoid significant coupling power into higher order modes. See Wyatt at Col. 7, lines 1-5; Col 7, line 55 to Col. 8, line 3 and Col. 8, lines 25-34.. Thus, Wyatt teaches against the bent fiber now defined in Claim 55 and its dependent claims. Since Fermann does not disclose the use of multi-mode fiber, these claims should be issued.

CLAIM 58

The same combination of references (Fermann and Wyatt) was used to reject Claim 58. This claim is amended herein to define:

“[means] a tapered length of multi-mode fiber for confining the optical energy amplified by said multi-mode optical fiber to substantially the fundamental mode of said multi-mode optical fiber.”

Neither Fermann nor Wyatt suggests tapering multi-mode fiber. As amended, Claim 58 should be allowed.

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SUMMARY

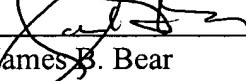
Applicant has endeavored to amend all of the pending claims to avoid the prior art, and respectfully requests that, in view of this amendment and the interview with the Examiner, this case be passed to issue.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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